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SID 62-99-34

MONTHLY WEIGHT AND BALANCE REPORT

FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150

(U)

PARAGRAPH 8.10 EXHIBIT I

1 DECEMBER 1964

(NASA-CR-116628) MONTHLY WEIGHT AND BALANCE REPORT FOR THE APOLLO SPACECRAFT (North American Aviation, Inc.) 48 p

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62-99-34

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SPACE and INFORMATION SYSTEMS DIVISION

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TECHNICAL REPORT INDEX/ABSTRACT

C65-8607

ACCESSION NUMBER						DOCUMENT SECURITY CLASSIFICATION	

TITLE OF DOCUMENT

Monthly Weight and Balance Report for the Apollo Spacecraft

LIBRARY USE ONLY

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1 December 1964	NAS9-150

DESCRIPTIVE TERMS

ABSTRACT

The Monthly Weight and Balance Report for the Apollo Spacecraft is filed in accordance with Paragraph 8.10 Exhibit I and is a summary type weight report. This report reflects the current weight of the Block I and Block II manned vehicles and explains the changes in weight from the previous report. This report also reflects the mission weight, center of gravity, inertia summary and dimensional diagrams.

For Block I Mass Properties Design Data refer to SID 64-1700, dated 16 October 1964. The Block II Mass Properties Design Data reference document will be listed at a later date.

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INTRODUCTION

The December report continues to reflect the current Block II LOR spacecraft. The current weight status summarizes the changes from the previous Block II status in addition to the changes from the previous Block I status. The Potential Weight Change Section of this report has been revised to include item numbers for all potential changes. These items will be noted in the Introduction when incorporated in the current status weights. The direction to delete the propellant dispersal system and the SPS isolation valves was received too late to be accomplished in this report and will be incorporated in the January report.

The current status reflects an unballasted Command Module L/D at entry of .34 for Block I and .38 for Block II. The current report reflects a Block II LOR spacecraft increase of 180 pounds at injection and 45 pounds at the injected spacecraft condition less Service Module propellant. The current injected weight of 90,730 pounds is based on a Service Module propellant loading for a specific impulse of 313.0 seconds, a ΔV budget as defined in SID 64-1344 and includes an increase in propellant required for adapter attaching ring which remains with CSM after adapter separation. This is based on a Lunar Excursion Module of 29,500 pounds, excluding crew for Block II.

The current Block I status reflects a standard manned vehicle based on a 10.6 day mission. The major changes in the Block I are:

Command Module - Addition of Flotation System and sea pick-up hook, redesign of main parachutes for higher descending weights and incorporation of unitized crew couch design.

Service Module - Deletion of Service Module RCS temperature control system (Integrated ECS-TCS) and addition of RCS heaters.

Launch Escape System - Addition of provisions to the boost protective cover to accomplish rapid opening, increase in main thrust motors based on average actual weights and an increase in ballast consistent with Command Module and LES burnout balance requirements.

The current Block II status reflects a 10.6 day LOR mission. The major changes in the Block II are:

Service Module - Addition of Extra Vehicular Transfer Catches and Platform.

Launch Escape System - Increase in main thrust motor based on average actual weights and an increase in ballast consistent with Command Module and LES burnout balance requirements.

The Earth Orbit Mission Weight Summary reflects the Block I vehicle on the Saturn IB booster with a payload capability in orbit of 33,500 pounds. The payload capability has been reduced by 220 pounds to 33,280 pounds, due to the effective weight penalty of the Launch Escape System, as defined in MSFC Memorandum of 12 June 1964 - Subject: Recommended Saturn IB Launch Vehicle Control Weights. The Service Module is loaded with 8,980 pounds of propellant.

BLOCK I

APOLLO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

1 DECEMBER STATUS

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT^2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10700	1042.7	0.6	5.3	5168	4496	4074
SERVICE MODULE - Less Propellant	9850	909.6	0.8	-1.3	6459	10362	10126
TOTAL - Less Propellant	20550	978.9	0.7	2.1	11610	34414	33710
PROPELLANT - S/M**	8980	869.8	27.3	-11.5	2990	2094	2535
TOTAL - With Propellant	29530	945.7	8.8	-2.0	15805	52815	53255
ADAPTER - S-IV B	3750	643.4	0.0	0.0	9289	12778	12664
TOTAL - Injected	33280	911.7	7.8	-1.8	25152	131240	131619
LAUNCH ESCAPE SYSTEM	8145	1299.6	0.0	-0.2	542	20238	20244
TOTAL - Spacecraft Launch	41425	987.9	6.3	-1.5	25783	364041	364509

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**The earth orbital weights are based on a complete Service Module and includes 8980 pounds of propellant. The propellant loading allocation is based on a payload in orbit of 33500 pounds. The payload capability has been reduced by 220 pounds to include the effective weight penalty due to the Launch Escape System increase from 6600 pounds to 8145 pounds.

BLOCK II

APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

1 DECEMBER STATUS

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT^2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10070	1043.0	0.4	6.3	4677	4202	3855
SERVICE MODULE - Less Propellant	10100	915.2	-5.1	7.9	7023	10787	10729
TOTAL - Less Propellant	20170	979.0	-2.4	7.1	11667	32663	32289
PROPELLANT - S/M*	37360	900.7	2.9	-1.2	19427	17738	24437
TOTAL - With Propellant	57530	928.2	1.1	1.7	31367	67931	74140
LUNAR EXCURSION MODULE	29500	588.5	0.0	0.0	19409	21485	21219
ADAPTER - LEM - S-IV B	3700	645.3	0.0	0.0	9304	12779	12663
TOTAL - Injected	90730	806.2	0.7	1.1	60098	609335	615154
LAUNCH ESCAPE SYSTEM	7980	1296.3	0.0	-0.2	547	20230	20224
TOTAL - SPACECRAFT LAUNCH	98710	845.8	0.6	1.0	60649	1009869	1015680

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**The propellant weight of 37360 pounds is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0, and includes 310 pounds of loading tolerance allowance.

BLOCK I

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

1 DECEMBER STATUS

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT^2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10700	1042.7	0.6	5.3	5168	4496	4074
LAUNCH ESCAPE SYSTEM	8145	1299.6	0.0	-0.2	542	20238	20244
TOTAL - Launch Abort	18845	1153.7	0.3	2.9	5740	90643	90197
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3198	1294.3	0.0	0.0	-71	-1337	-1337
TOTAL - LES Burnout	15647	1125.0	0.4	3.5	5662	72871	72433

NOTE: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

BLOCK II

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

1 DECEMBER STATUS

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT^2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10070	1043.0	0.4	6.3	4677	4202	3855
LAUNCH ESCAPE SYSTEM	7980	1296.3	0.0	-0.2	547	20230	20224
TOTAL - Launch Abort	18050	1155.0	0.2	3.4	5265	86127	85733
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3198	1294.3	0.0	0.0	-71	-1337	-1337
TOTAL - LES Burnout	14852	1125.0	0.3	4.2	5184	68447	68114

NOTE: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

BLOCK I

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

EARTH ORBIT MISSION

1 DECEMBER STATUS

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10700	1042.7	0.6	5.3	5168	4496	4074	10	-225	14
Less: Boost & Mission Water	-8	1022.6	-63.4	-16.4						
Food	-62	1053.0	-28.6	37.0						
Add: Waste-Fecal	15	1039.0	47.0	12.0						
CO_2 Absorbed (22 Cart.)	51	1016.8	-4.2	27.7						
Potable Water	30	1022.6	-63.4	-16.4						
Waste Water	56	1022.5	-21.1	61.8						
PRIOR TO ENTRY	10782	1042.4	0.6	5.5	5230	4542	4116	26	-248	19
Less: Propellant	-135	1022.6	-5.1	56.6						
Ablator Burnoff	-365	1016.2	-0.4	15.7						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-414	1098.5	0.0	0.4						
Drogue Chutes	-56	1089.1	0.0	-21.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9806	1041.0	0.7	4.8	4771	3819	3469	22	-159	26
Less: Main Chutes (3)	-427	1090.8	-1.8	6.2						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	9244	1039.0	0.9	4.0	4609	3468	3156	32	-140	33

NOTE: Mass inertia data is shown for accumulative totals only.

BLOCK II

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

1 DECEMBER STATUS

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10070	1043.0	0.4	6.3	4677	4202	3855	11	-278	26
Less: Boost & Mission Water	-8	1022.6	-63.4	-16.4						
Food	-54	1050.0	22.0	41.5						
Docking	-150	1110.0	0.0	0.0						
Add: Waste-Fecal	15	1039.0	47.0	12.0						
CO_2 Absorbed (20 Cart.)	46	1015.4	0.0	28.5						
Potable Water	30	1022.6	-63.4	-16.4						
Waste Water	56	1022.5	-21.1	61.8						
PRIOR TO ENTRY	10005	1041.7	0.1	6.6	4736	4091	3750	21	-283	10
Less: Propellant	-135	1022.6	-5.1	56.6						
Ablator Burnoff	-365	1016.2	-0.4	15.7						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-300	1090.0	0.0	1.0						
Drogue Chutes	-56	1089.1	0.0	-21.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9143	1041.1	0.2	5.8	4303	3523	3252	16	-205	16
Less: Main Chutes (3)	-417	1090.4	-1.2	7.5						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	8591	1039.0	0.4	5.0	4147	3187	2950	20	-189	25

NOTE: Mass inertia data is shown for accumulative totals only.

BLOCK I

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

1 DECEMBER STATUS

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10700	1042.7	0.6	5.3	5168	4496	4074	10	-225	14
Less: Oxidant	-180	1022.6	15.6	62.4						
Forward Heat Shield	-414	1098.5	0.0	0.4						
Drogue Chutes	-56	1089.1	0.0	-21.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	10050	1040.5	0.4	4.6	4935	3979	3679	24	-144	-19
Less: Main Chutes (3)	-427	1090.8	-1.8	6.2						
Fuel	-90	1022.6	-46.5	44.9						
LANDING	9533	1038.4	0.9	4.2	4804	3674	3346	21	-139	15

NOTE: Mass inertia data is shown for accumulative totals only.

BLOCK II

COMMAND MODULE

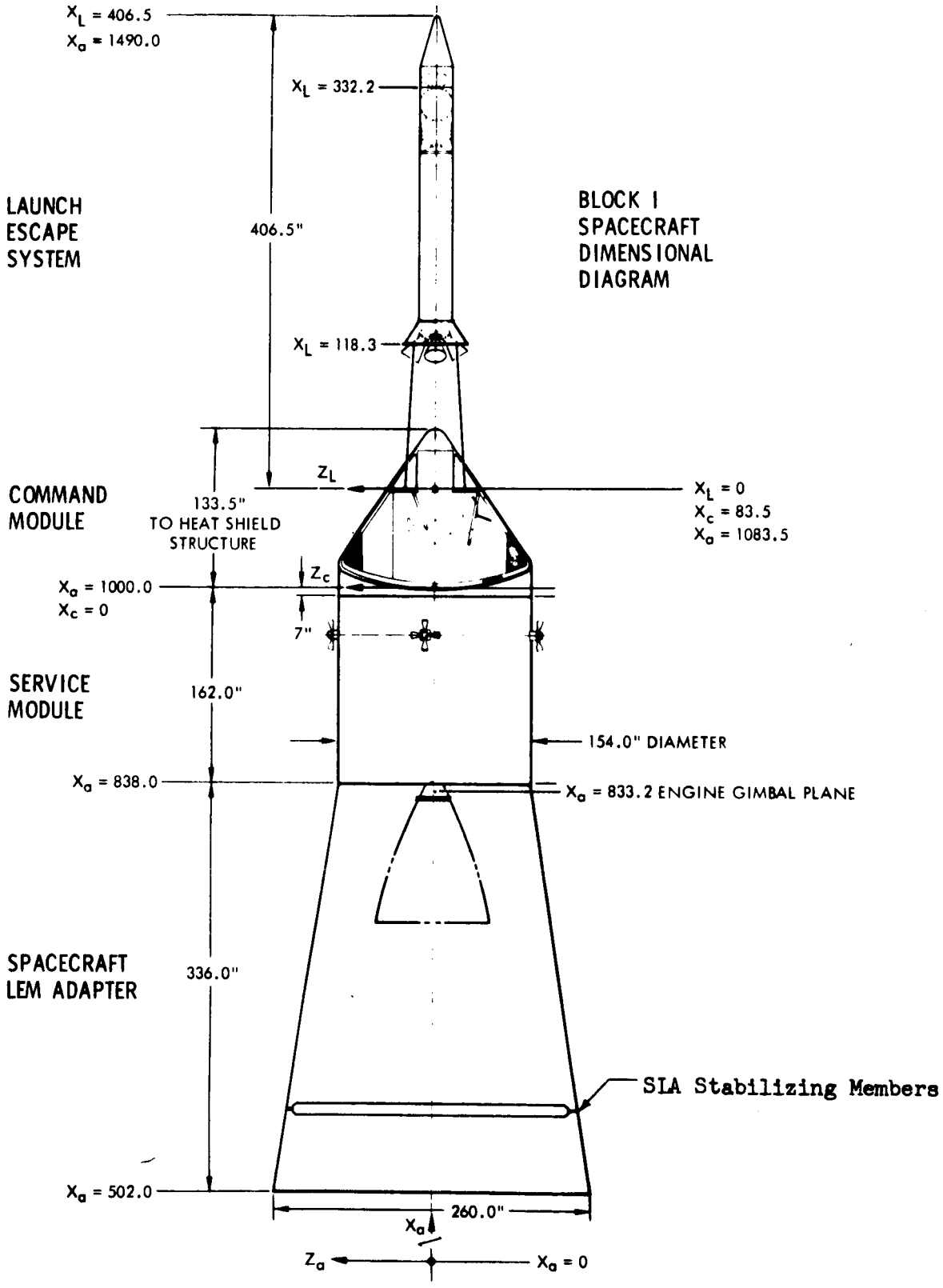
WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

1 DECEMBER STATUS

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10070	1043.0	0.4	6.3	4677	4202	3855	11	-278	26
Less: Oxidant	-180	1022.6	15.6	62.4						
Forward Heat Shield	-300	1090.0	0.0	1.0						
Docking Provisions	-150	1110.0	0.0	0.0						
Drogue Chutes	-56	1089.1	0.0	-21.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9384	1040.5	0.1	5.7	4464	3685	3456	24	-191	-7
Less: Main Chutes (3)	-417	1090.4	-1.2	7.5						
Fuel	-90	1022.6	-46.5	44.9						
LANDING	8877	1038.4	0.7	5.2	4338	3394	3134	16	-188	30

NOTE: Mass inertia data is shown for accumulative totals only.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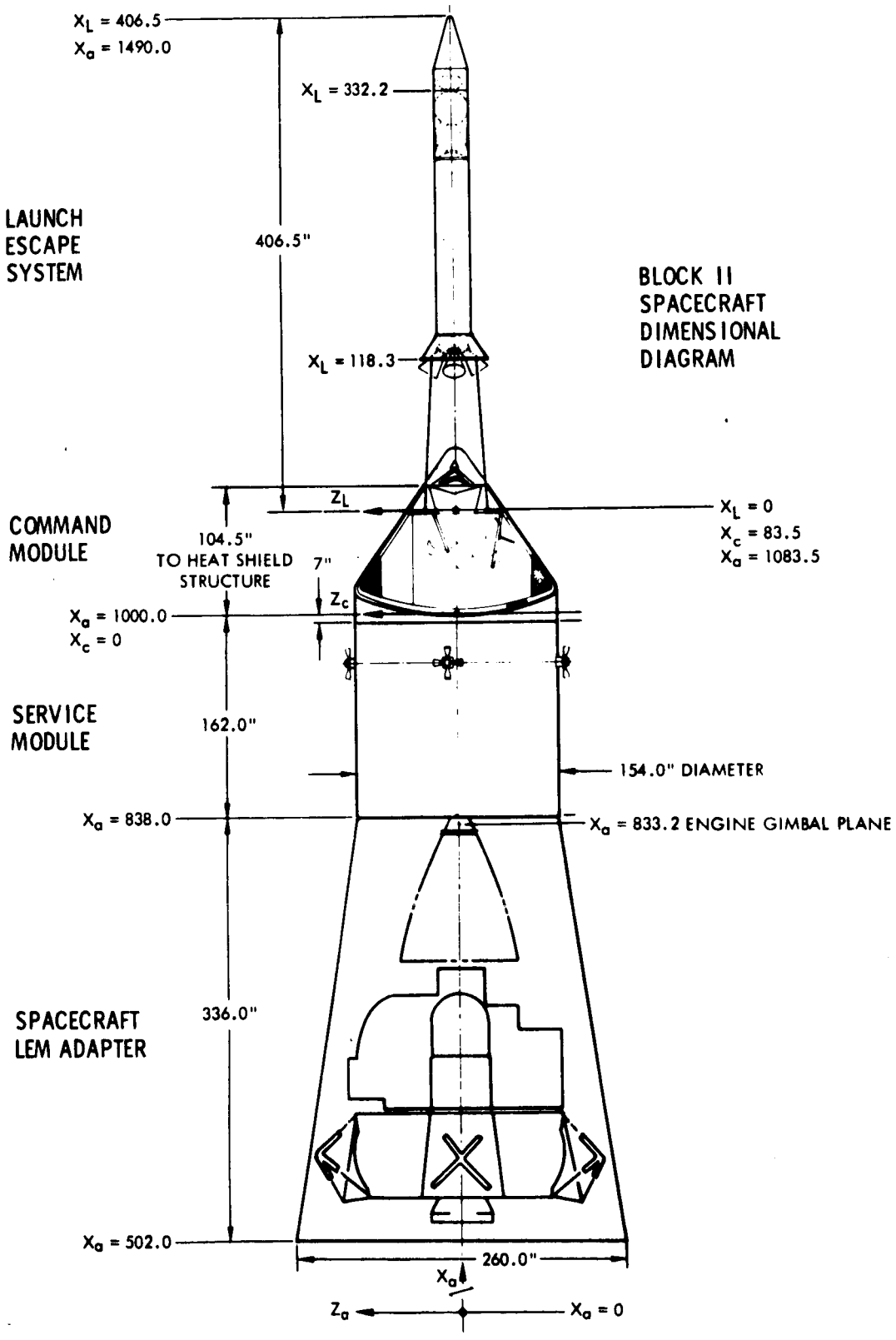
X_a = 1490.0
X_L = 332.2
LAUNCH ESCAPE SYSTEM
406.5"
BLOCK I SPACECRAFT DIMENSIONAL DIAGRAM
X_L = 118.3
Z_L
COMMAND MODULE
133.5" TO HEAT SHIELD STRUCTURE
X_L = 0
X_c = 83.5
X_a = 1083.5
X_a = 1000.0
X_c = 0
Z_c
7"
SERVICE MODULE
162.0"
154.0" DIAMETER
X_a = 838.0
X_a = 833.2 ENGINE GIMBAL PLANE
SPACECRAFT LEM ADAPTER
336.0"
SIA Stabilizing Members
X_a = 502.0
260.0"
X_a
Z_a
X_a = 0


X_L = 406.5
X_a = 1490.0
X_L = 332.2
LAUNCH ESCAPE SYSTEM
406.5"
X_L = 118.3
BLOCK II SPACECRAFT DIMENSIONAL DIAGRAM
Z_L
X_L = 0
X_c = 83.5
X_a = 1083.5
COMMAND MODULE
104.5" TO HEAT SHIELD STRUCTURE
7"
Z_c
X_a = 1000.0
X_c = 0
SERVICE MODULE
162.0"
154.0" DIAMETER
X_a = 838.0
X_a = 833.2 ENGINE GIMBAL PLANE
SPACECRAFT LEM ADAPTER
336.0"
X_a = 502.0
260.0"
X_a
Z_a
X_a = 0

BLOCK I

SPACECRAFT

WEIGHT STATUS SUMMARY

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK I STATUS		
				%EST	%CAL	%ACT
COMMAND MODULE	10655	+45	10700	24	74	2
SERVICE MODULE	9950	-100	9850	9	80	11
LAUNCH ESCAPE SYSTEM	8100	+45	8145	15	8	77
ADAPTER	3750		3750	27	73	
TOTAL WEIGHT LAUNCH - LESS SPS PROPELLANT	32455	-10	32445	18	59	23

BLOCK II

SPACECRAFT

WEIGHT STATUS SUMMARY

(LESS LEM)

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK II STATUS		
				%EST	%CAL	%ACT
COMMAND MODULE	10070		10070	54	46	
SERVICE MODULE	10055	+45	10100	30	65	5
LAUNCH ESCAPE SYSTEM	7945	+35	7980	13	9	78
ADAPTER	3700		3700	26	74	
TOTAL LESS PROPELLANT	31770	+80	31850	33	46	21
PROPELLANT	37225	+135	37360		100	
GROSS WEIGHT	68995	+215	69210	15	75	10

INJECTED SPACECRAFT

WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64
COMMAND MODULE	10070		10070
SERVICE MODULE	10055	+45	10100
ADAPTER	3700		3700
LEM	29500		29500
TOTAL S/C INJECTED LESS PROPELLANT	53325	+45	53370
PROPELLANT	37225	+135	37360
TOTAL INJECTED WEIGHT	90550	+180	90370

BLOCK I

COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK I STATUS		
				%EST	%CAL	%ACT
WEIGHT EMPTY	(9342)	(+49)	(9391)	(27)	(71)	(2)
Structure	5176	+52	5228	12	85	3
Stabilization & Control	198		198	10	90	
Guidance & Navigation	430		430		100	
Crew Systems	374	-70	304	86	14	
Environmental Control	311		311	35	57	8
Earth Landing System	552	+45	597	12	88	
Instrumentation	268	+7	275	84	16	
Electrical Power	1210	+13	1223	91	9	
Reaction Control	304	-4	300	14	86	
Communication	319	+6	325	2	98	
Controls & Displays	200		200	13	87	
USEFUL LOAD	(1313)	(-4)	(1309)	(4)	(96)	
Scientific Equipment	80		80		100	
Crew Systems	840		840	7	93	
Reaction Control	270		270		100	
Environmental Control	123	-4	119		100	
GROSS WEIGHT	10655	+45	10700	24	74	2

BLOCK II

COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK II STATUS		
				%EST	%CAL	%ACT
WEIGHT EMPTY	(8643)	(+4)	(8647)	(62)	(38)	
Structure	4913	+2	4915	54	46	
Stabilization & Control	177		177	100		
Guidance & Navigation	397		397	100		
Crew Systems	298		298	93	7	
Environmental Control	340	-3	337	60	40	
Earth Landing System	567	+10	577	20	80	
Instrumentation	81		81	100		
Electrical Power	1046	+7	1053	93	7	
Reaction Control	304	-4	300	14	86	
Communication	274	-5	269	100		
Controls & Displays	246	-3	243	70	30	
USEFUL LOAD	(1427)	(-4)	(1423)	(4)	(96)	
Scientific Equipment	80		80		100	
Crew Systems	963		963	6	94	
Reaction Control	270		270		100	
Environmental Control	114	-4	110		100	
GROSS WEIGHT	10070		10070	54	46	

COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

	BLOCK I	BLOCK II
STRUCTURE	(+52.0)	(+2.0)
Add a sea pick-up loop to faciliate retrieval of Command Module after impact.	+15.0	-
Add a (3) bag flotation system to ensure that the Command Module will float in a stable Apex-up attitude.	+40.0	-
Increase heat shield substructure center section due to the addition of handles to the inside of the outer hatch to faciliate handling of the hatch while on the pad thus preventing damage to the ablative material.	+1.0	+1.0
Increase secondary structure crew area due to the addition of a crew hatch retention cable.	+1.0	+1.0
Decrease secondary structure aft equipment bay due to the deletion of stowage provisions for the PLSS and expendables based on the NASA direction eliminating the requirement for the PLSS on Block I spacecrafts.	-5.0	-
CREW SYSTEMS	(-70.0)	-
Decrease crew couches due to incorporating a unitized crew couch system consisting of simplified construction plus remote seat fold capability.	-70.0	-
ENVIRONMENTAL CONTROL	-	(-3.0)
Decrease subcontractor weights to be consistent with Block II estimates based on the current Block I AiResearch status.	-	-3.0
EARTH LANDING SYSTEM	(+45.0)	(+10.0)
Increase parachute subsystem due to redesign to a higher descent weight.	+35.0	-

COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

	BLOCK I	BLOCK II
EARTH LANDING SYSTEM (CONT'D.)		
Increase the drogue chute system based on current Northrop status reflecting a material change in the mortar breech from titanium to steel.	+0.7	+0.7
Increase main chute cluster based on current Northrop status reflecting an increase in the fourth sail material from 1.1 ounce to 2.25 ounce nylon and lengthen deployment bag bridal straps for handling and installation.	+8.6	+8.6
Increase pilot chute system based on current Northrop status reflecting a change in pilot fairings to casting and the addition of seals to sabots to reduce gas leakage.	+0.7	+0.7
INSTRUMENTATION	(+7.0)	-
Add a display meter and selector switching for intermittent monitoring of operational measurements formerly accessible via the inflight test system.	+5.0	-
Increase flight qualification tape recorder based on vendor information replacing magnesium parts with aluminum due to salt fog test requirement.	+2.0	-
ELECTRICAL POWER	(+13.0)	(+7.0)
Increase wire channels based on calculation of preliminary drawings reflecting addition of protective wire covers.	+10.0	+4.0
Increase RCS sequence panels due to revised calculation based on current requirements.	+3.0	+3.0
REACTION CONTROL	(-4.0)	(-4.0)
Decrease engines based on Rocketdyne status reflecting minor design changes and partial actual weight.	-4.0	-4.0

COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

	BLOCK I	BLOCK II
COMMUNICATIONS	(+6.0)	(-5.0)
Decrease communication equipment based on Collins information reflecting re-evaluation of orbital capability, humidity and EMI fixes.	-0.5	-
Increase tape recorder based on vendor information replacing magnesium parts with aluminum due to salt fog requirements.	+5.0	+2.0
Decrease multiplexer based on revised estimated of Block II requirements.	-	-1.0
Increase antenna transmission lines based on current estimated coax lengths.	+1.5	
Decrease antennas and transmission lines based on current estimates of Block II requirements.	-	-6.0
CONTROLS AND DISPLAYS	(-)	(-3.0)
Increase display panels based on calculation of current released drawings.	+3.0	-
Delete controls for Service Module temperature control system.	-3.0	-3.0
TOTAL COMMAND MODULE CURRENT WEIGHT EMPTY CHANGES.	(+ 49.0)	(+4.0)

COMMAND MODULE

CURRENT USEFUL LOAD CHANGES

	BLOCK I	BLOCK II
ENVIRONMENTAL CONTROL	(-4.0)	(-4.0)
Delete one lithium hydroxide cartridge based on calculation of current requirements utilizing 96 per cent efficiency.	-4.0	-4.0
TOTAL This page	-4.0	-4.0
TOTAL COMMAND MODULE CURRENT WEIGHT EMPTY CHANGE	+49.0	+ 4.0
TOTAL COMMAND MODULE CURRENT WEIGHT CHANGES	+45.0	-

BLOCK I

SERVICE MODULE WEIGHT STATUS

	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK I STATUS		
				%EST	%CAL	%ACT
WEIGHT EMPTY	(7831)	(-100)	(7731)	(11)	(75)	(14)
Structure	2348	+7	2355	8	77	15
Environmental Control	211	-119	92		100	
Instrumentation	34		34	100		
Electrical Power	1604	+11	1615	24	30	46
Main Propulsion	3057		3057	4	96	
Reaction Control	563	+3	566	20	80	
Communication & Rendezvous Radar	14	-2	12	100		
USEFUL LOAD	(2119)		(2119)		(100)	
Reaction Control	838		838		100	
Electrical Power	503		503		100	
Environmental Control	208		208		100	
Main Propulsion	570		570		100	
TOTAL SERVICE MODULE BURNOUT	9950	-100	9850	9	80	11

BLOCK II

SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK II STATUS		
				%EST	%CAL	%ACT
WEIGHT EMPTY	(7900)	(+45)	(7945)	(39)	(55)	(6)
Structure	2451	+44	2495	36	64	
Environmental Control	117		117	20	80	
Instrumentation	37		37	100		
Electrical Power	1608	-8	1600	38	30	32
Main Propulsion	2883		2883	38	62	
Reaction Control	576	+1	577	30	70	
Communications & Rendezvous Radar	228	+8	236	100		
USEFUL LOAD	(2155)		(2155)		(100)	
Reaction Control	838		838		100	
Electrical Power	503		503		100	
Environmental Control	208		208		100	
Main Propulsion	606		606		100	
TOTAL SERVICE MODULE BURNOUT	10055	+45	10100	30	65	5

SERVICE MODULE

CURRENT WEIGHT EMPTY CHANGES

	BLOCK I	BLOCK II
STRUCTURE	(+7.0)	(+44.0)
Increase Command Module to Service Module fairing due to adding strips to support the Command Module boost protective cover.	+7.0	+7.0
Add Service Module mounted EVT catch and latch provisions including EVT platform to enable the secondary docking device to engage and allow EVT.	-	+30.0
Increase cross sectional area of radial beam trusses due to increased loads in the shear and compression pads based on current aerodynamic data.	-	+7.0
ENVIRONMENTAL CONTROL	(-119.0)	-
Delete water glycol temperature control system required for Service Module RCS engines due to addition to the RCS engines of heaters with thermostatic controls.	-100.0	-
Transfer TCS support shelf to Electrical Power System as this shelf is being utilized to support the power distribution box.	-19.0	-
Decrease the subcontractor valves based on current AiResearch status reflecting actual weights.	-2.7	-2.7
Increase plumbing and hardware based on calculation of current released drawing changes.	+2.7	+2.7
ELECTRICAL POWER	(+11.0)	(-8.0)
Increase cryogenic system based on current Beech status reflecting partial actual weights.	+0.4	+0.4
Decrease fuel cell based on current Pratt and Whitney status reflecting material changes in plumbing to titanium and revised calculations.	-8.4	-8.4
Transfer TCS support shelf from Environmental Control based on current design which mounts the power distribution box to the support shelf.	+19.0	-

SERVICE MODULE

CURRENT WEIGHT EMPTY CHANGES

	BLOCK I	BLOCK II
REACTION CONTROL	(+3.0)	(+1.0)
Increase engine system due to the addition of engine heaters in lieu of a water glycol temperature control system.	+2.0	-
Increase engines based on current Marquardt status reflecting a change in electrical leads.	+0.8	+0.8
Decrease tanks based on current Bell status reflecting a bladder redesign.	-1.8	-1.8
Increase quantity gauging system based on current Giannini status reflecting actual weight of first system.	+2.0	+2.0
COMMUNICATION AND RENDEZVOUS RADAR	(-2.0)	(+8.0)
Decrease orbital HF antenna based on re-evaluation of antenna and coax.	-2.0	-
Increase high gain antenna based on revised estimate of the antenna coax.	-	+7.0
Increase VHF antenna coax based on revised estimate of the antenna coax.	-	+1.0
TOTAL SERVICE MODULE CURRENT WEIGHT EMPTY CHANGES	-100.0	+45.0

BLOCK I

LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK I STATUS		
				%EST	%CAL	%ACT
Structure	1534		1534		43	57
Ballast Instl. Prov.	29		29		100	
Electrical System	53		53	73	27	
Propulsion System						
Main Thrust	4774	+20	4794			100
Jettison	434		434			100
Jettison Motor Skirt	92		92			100
Pitch Control	49		49			100
Separation Provisions	16		16	53	47	
C/M Boost Prot. Cover	520	+15	535	100		
LES - NO BALLAST	7501	+35	7536	8	9	83
BALLAST	599	+10	609	100		
TOTAL LAUNCH ESCAPE SYSTEM	8100	+45	8145	15	8	77

BLOCK II

LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK II STATUS		
				%EST	%CAL	%ACT
Structure	1534		1534		43	57
Ballast Instl. Prov.	29		29		100	
Electrical	53		53	73	27	
Propulsion System						
Main Thrust	4774	+20	4794			100
Jettison	434		434			100
Jettison Motor Skirt	92		92			100
Pitch Control	49		49			100
Separation Provisions	16		16	53	47	
C/M Boost Prot. Cover	535		535	100		
LES - NO BALLAST	7516	+20	7536	8	9	83
BALLAST	429	+15	444	100		
TOTAL LAUNCH ESCAPE SYSTEM	7945	+35	7980	13	9	78

LAUNCH ESCAPE SYSTEM

CURRENT WEIGHT CHANGES

	BLOCK I	BLOCK II
BOOST PROTECTIVE COVER	(+15.0)	-
Increase boost cover due to adding provisions to accomplish rapid opening of the main hatch for egress while on the pad.	+15.0	-
PROPULSION SYSTEM	(+20.0)	(+20.0)
Increase main thrust motor based on current Lockheed status reflecting average actual weights of the production escape motors.	+20.0	+20.0
BALLAST	(+10.0)	(+15.0)
Increase ballast consistent with Command Module and LES balance requirement.	+10.0	+15.0
TOTAL LAUNCH ESCAPE SYSTEM CURRENT WEIGHT CHANGES	+45.0	+35.0

BLOCK I

ADAPTER WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK I STATUS		
				%EST	%CAL	%ACT
Structure (Includes Stabilizing Members)	3250		3250	17	83	
Electrical	70		70	82	18	
Separation System	330		330	90	10	
Propellant Dispersal System	100		100	100		
TOTAL ADAPTER	3750		3750	27	73	

BLOCK II

ADAPTER WEIGHT STATUS

ITEM	PREVIOUS STATUS 11-1-64	CHANGES TO CURRENT	CURRENT STATUS 12-1-64	BASIS FOR CURRENT BLOCK II STATUS		
				%EST	%CAL	%ACT
Structure	3175		3175	15	85	
Electrical	70		70	82	18	
Separation System	330		330	90	10	
Propellant Dispersal System	125		125	100		
TOTAL ADAPTER	3700		3700	26	74	

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

STRUCTURE	(-313.0)
Decrease ablator due to incorporating a boost protective cover to carry the boost and abort loads and allow the ablator to be designed for entry temperatures only, also add a thermal control coating which allows a reduction in temperature of the ablator prior to entry from +250 to+100 F and allows a reduction of required ablator thickness.	-265.0
Decrease ablator based on reduced ablator thickness accomplished by changing the backface design temperature criteria of +600 F at impact to +600 F at parachute deployment for the aft heat shield ablator.	-50.0
Decrease ablator due to redesign incorporating a flat top forward heat shield that is cut back to Station 104.5 and allows external mounting of the docking system which is protected by the Boost Protective Cover.	-20.0
Decrease forward heat shield due to redesign incorporating a flat top forward heat shield that is cut back to Station 104.5 and allows external mounting of the docking system.	-35.0
Increase side hatch cover due to adding provisions to operate the hatch cover latches from the outside and add an aluminum inner sheet which will compensate for thermal distortion experienced when it is opened in deep space.	+10.0
Decrease inner structure due to redesign utilizing a single-point "static gimbal" (flower-pot) chute riser attachment. This arrangement removes the concentrated chute loads from the longerons, and eliminates the main chute riser wrap-around loads from the bulkhead gussets and from the forward cylinder.	-79.0
Decrease the side access hatch and hatch cover due to deleting the window which will not be used for any Apollo lunar landing missions.	-25.0
Increase parachute attach fittings consistent with Block II single-point attachment.	+13.0

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

STRUCTURE (CONT'D.)

Increase center section heat shield substructure due to the attachment of the relocated horizontally mounted forward pitch motor assembly.	+7.0
Decrease crew compartment heat shield substructure due to utilizing titanium in lieu of steel for the aft compartment (pork chop) frames.	-41.0
Decrease main display panel due to integrating the various subpanels originally provided to allow design flexibility.	-4.0
Decrease lower equipment bay structure and coldplates due to redesign incorporating full electronic repackaging and method of mounting equipment to the frames at X_c 42 and 20 thus reducing the number of vertical members required.	-45.0
Decrease forward heat shield due to removal of access door to pitch motor.	-5.0
Add lower equipment bay supports required for food compartment which were previously provided by Crew Systems.	+8.0
Add a docking system consisting of a probe and drogue mechanism required to transfer two crewman from CM vehicle to the LEM vehicle in lunar rendezvous.	+150.0
Increase secondary structure heat shield equipment area due to the relocation of the Command Module to Service Module umbilical.	+30.0
Delete secondary structure supports required for Block I R & D equipment. (R & D provisions will be defined for each end item Block II vehicle.)	-27.0
Add weight reduction contingency.	+60.0
Add mounting and stowage provisions for PLSS's and expendables.	+5.0

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

STABILIZATION & CONTROL	(-21.0)
Decrease equipment due to repackaging for the ring mounted lower equipment bay concept and incorporating redundant switching for eliminating inflight maintenance consistent with humidity and EMI proofing.	-26.0
Add weight reduction contingency.	+5.0
GUIDANCE AND NAVIGATION	(-33.0)
Decrease equipment due to incorporating the Block II G & N system for the lunar spacecraft.	-37.0
Add weight reduction contingency.	+4.0
CREW SYSTEMS	(-6.0)
Increase egress accessories due to adding aids for extra vehicular activities.	+10.0
Delete food storage box supports as this requirement has been integrated with secondary structure design.	-17.0
Add weight reduction contingency.	+1.0
ENVIRONMENTAL CONTROL	(+26.0)
Add a free condensate control required to minimize the amount of condensation in the cabin which if excessively accumulated would harmfully affect the respiration of the crew and cause degradation of electronic equipment.	+10.0
Provide the CO_2 absorber elements with a bypass in order to attain minimum oxygen flow of 10 CFM/Man in 3.5 psia (suited) condition.	+10.0
Add a LEM water transfer system.	+5.0
Add weight reduction contingency.	+1.0
EARTH LANDING SYSTEM	(-20.0)
Incorporate Block II configuration utilizing a single point parachute attachment and repackaging of chutes.	-20.0

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

INSTRUMENTATION	(-194.0)
Delete R & D instrumentation required for flight qualifications. (R & D provisions will be defined for each end item Block II vehicle.)	-188.0
Decrease PCM equipment due to repackaging for the ring mounted lower equipment concept.	-12.0
Add weight reduction contingency.	+6.0
ELECTRICAL POWER	(-170.0)
Add a DC-DC line voltage regulator to regulate the output at 28 $\pm$ 0.5 volts for postlanding loads.	+4.0
Increase entry-postlanding batteries based on current landing and postlanding loads.	+21.0
Increase electrical wiring and connectors consistent with the 1300 wire umbilical requirements.	+159.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-240.0
Decrease wiring based on relocating CM to SM umbilical.	-60.0
Decrease crew compartment wire channel covers based on relocated umbilical.	-6.0
Delete wiring provisions for Service Module temperature control system.	-4.0
Delete R & D instrumentation wiring and provisions. (R & D provisions will be defined for each end item Block II vehicle.)	-136.0
Add wiring provisions for the rendezvous radar equipment.	+17.0
Decrease wiring due to reducing requirement of the controls and displays computer keyboard.	-5.0
Add wiring to provide connection between the caution and warning panel and the units previously tested with the in-flight test system.	+5.0
Add Nuclear Radiation Detection Wiring provisions required for the lunar vehicle.	+1.0

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

ELECTRICAL POWER (CONT'D.)	
Add provisions for S-IV B EDS interface.	+20.0
Add checkout provisions for the LEM in the stowed and docked position.	+31.0
Add wiring for the up data link display.	+3.0
Add wiring for the high gain control.	+6.0
Decrease wiring based on lower equipment bay repackaging.	-20.0
Add wiring required for Block II Controls and Displays modifications.	+4.0
Add weight reduction contingency.	+30.0
COMMUNICATIONS	(-56.0)
Delete C-Band antenna and utilize S-Band for low altitude tracking.	-19.7
Decrease equipment and wiring due to repackaging for the ring mounted lower equipment bay concept incorporating humidity and EMI proofing consistent with no inflight maintenance.	-32.7
Replace the scimitar antenna with the "S" band antenna.	+17.9
Transfer the VHF antenna to the Service Module.	-26.4
Decrease VHF recovery antenna based on new configuration of antenna for the Block II vehicle.	-4.5
Add coax cabling required for the high gain antenna.	+2.4
Add weight reduction contingency.	+9.0
Delete orbital HF voice communication capability.	-2.0

COMMAND MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

CONTROLS AND DISPLAYS	(+43.0)
Chem-etch mounting panels for the LOR vehicles that could not be accomplished due to schedule on Block I.	-4.0
Add rendezvous radar panel required for LOR mission.	+7.0
Add Nuclear Radiation Display.	+3.5
Add high gain antenna control required for deep space communication.	+4.5
Increase caution and warning detector.	+6.5
Modify control and display for the lunar vehicle.	+17.8
Decrease main display panel due to eliminating subpanels and display by increasing time sharing of display.	-5.8
Add an angle of attack display.	+1.5
Add a teleprinter display which shall display messages and data directed to it from the up-data link equipment.	+10.0
Add weight reduction contingency.	+2.0
TOTAL COMMAND MODULE ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II (to be brought forward)	-744.0

COMMAND MODULE

CURRENT ESTIMATED USEFUL LOAD CHANGES FROM BLOCK I TO BLOCK II

CREW SYSTEM	(+123.0)
Add two portable life support systems based on the current requirements of the LOR vehicle and LEM.	+120.9
Decrease hygiene and medical storage boxes based on redesign of containers that cannot be accomplished on early Block I vehicles.	-6.9
Utilize Apollo spacesuits in lieu of Gemini.	+13.0
Add spare glove, repair kit and ring seals for the Apollo spacesuit per NASA.	+3.7
Decrease survival kit based on NASA information reflecting (1) three men life raft in lieu of (3) one man life rafts and their associated equipment.	-8.5
Decrease food based on current NASA requirement.	-9.7
Add two charged water cooled constant wear garments per current NASA list.	+7.0
Add weight reduction contingency.	+2.0
Increase portable light based on current LOR requirements.	+1.5
ENVIRONMENTAL CONTROL	(-9.0)
Decrease lithium hydroxide based on lunar mission analysis.	-9.0
TOTAL COMMAND MODULE ESTIMATED USEFUL LOAD CHANGES FROM BLOCK I TO BLOCK II	+114.0
TOTAL COMMAND MODULE ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II	-744.0
TOTAL COMMAND MODULE ESTIMATED CHANGES FROM BLOCK I TO BLOCK II	-630.0

SERVICE MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

STRUCTURE	(+140.0)
Add structural beef-up required to support the rendezvous radar equipment.	+35.0
Add structural provisions for supporting the high gain antenna required for deep space communication.	+30.0
Increase structural provisions for the C/M to S/M umbilical fairing due to enlarging the capacity to 1300 wires.	+9.0
Increase engine mount and backup structure due to stiffness requirements.	+50.0
Add micrometeoroid protection in outboard sectors of the four propellant tanks to afford the greatest reliability. The shielding will be of an internal type mounted directly to the outboard panels.	+110.0
Decrease structure due to reducing factor of safety from 1.5 to 1.4 on all structures requiring redesign.	-25.0
Decrease outer shell panel based on redesign to a simi-arched structure with a lesser end moment requirement and a change in the helium pressurization access door from structural to nonstructural.	-50.0
Decrease radial beams due to reduction in web gauges, stiffener cap area, and inner and outer cap areas.	-6.0
Decrease forward bulkhead due to redesigning to a spider truss structure in lieu of honeycomb panels.	-84.0
Decrease aft bulkhead due to a reduction of face sheet thickness, density of honeycomb core, and the outer ring.	-10.0
Add support shelves for relocated equipment from Sector I.	+50.0
Decrease insulation on aft bulkhead due to reduction in Q-felt density.	-9.0
Decrease outer shell panel due to an increase in radiator size required by philosophy change allowing selective freezing.	-10.0
Add weight reduction contingency.	+20.0
Add EVT provisions including platform and attach handles.	+30.0

SERVICE MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

ENVIRONMENTAL CONTROL	(+25.0)
Increase radiator size based on philosophy change allowing selective freezing.	+25.0
INSTRUMENTATION	(+3.0)
Add radiation detection sensors to the Service Module.	+3.0
ELECTRICAL POWER	(-15.0)
Increase intermodular plumbing due to adding radiator valves required on the Block II vehicles.	+9.0
Increase wiring, connectors and shape charge consistent with the 1300 wire umbilical.	+106.0
Decrease wiring and connectors based on reduced wire gauges and utilizing small connectors.	-130.0
Increase shape change based on relocated umbilical requirement.	+20.0
Decrease wiring based on relocating CM to SM umbilical.	-10.0
Decrease cryogenic tanks due to utilizing super insulation.	-31.0
Decrease sequencer based on removing battery and utilizing fuel cell power for pyrotechnics.	-7.0
Decrease oxygen tank support shelf consistent with Block II relocated shelf allowance.	-6.0
Delete wiring provisions for Service Module TCS.	-5.0
Add provisions for LEM monitoring in stowed position.	+22.0
Add wiring provisions for high gain antenna.	+13.0
Add wiring provision for rendezvous radar equipment.	+6.0
Delete support shelf for the power distribution panel based on Block II requirement for Bay I empty configuration.	-19.0
Add weight reduction contingency.	+17.0

SERVICE MODULE

CURRENT ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II

PROPULSION	(-174.0)
Decrease propellant and oxidizer tank gauges based on refined tank pressure regulation by utilizing precision valves which allow design for pressure relief at 225 psi rather than 240 psi.	-50.0
Decrease propellant and oxidizer tanks due to shortening the tanks for a 41,000 pound usable propellant.	-191.0
Add isolation valves to the SPS to allow for maintenance with loaded propellant tanks.	+40.0
Add weight reduction contingency.	+27.0
REACTION CONTROL SYSTEM	(+11.0)
Increase reflectors and insulation based on service module boost heating and RCS plume impingement.	+15.0
Reduce attachments for structural closeouts on RCS panels.	-8.0
Delete electric heaters required for RCS temperature control not required for Block II.	-2.0
Add weight reduction contingency.	+6.0
COMMUNICATIONS & RENDEZVOUS RADAR	(+224.0)
Add high gain antenna system required for deep space communications.	+63.0
Add rendezvous radar equipment consistent with the LOR requirements.	+143.0
Transfer VHF communication antenna from the Command Module.	+30.0
Delete orbital HF antenna required for Block I only.	-12.0
TOTAL SERVICE MODULE ESTIMATED WEIGHT EMPTY CHANGES TO BLOCK II (To be brought forward)	+214.0

SERVICE MODULE

CURRENT ESTIMATED USEFUL LOAD CHANGES FROM BLOCK I TO BLOCK II

MAIN PROPULSION	(+36.0)
Decrease Helium quantity based on reduced volume.	-11.0
Increase residuals consistent with current propellant requirements.	+47.0
TOTAL SERVICE MODULE ESTIMATED USEFUL LOAD CHANGES FROM BLOCK I TO BLOCK II	+36.0
TOTAL SERVICE MODULE ESTIMATED WEIGHT EMPTY CHANGES FROM BLOCK I TO BLOCK II	+214.0
TOTAL SERVICE MODULE ESTIMATED CHANGES FROM BLOCK I TO BLOCK II	+250.0

LAUNCH ESCAPE SYSTEM

CURRENT ESTIMATED WEIGHT CHANGES FROM BLOCK I TO BLOCK II

BALLAST	(-165.0)
Decrease ballast consistent with current Command Module LES balance requirements.	-165.0
TOTAL LAUNCH ESCAPE SYSTEM ESTIMATED WEIGHT CHANGES FROM BLOCK I TO BLOCK II	-165.0

ADAPTER

CURRENT ESTIMATED WEIGHT CHANGES FROM BLOCK I TO BLOCK II

Decrease S-IV B Adapter utilized on the Block I vehicles due to removing the structure trusses required to stiffen the Adapter when the LEM is not installed.	-75
Add a LEM dispersal system utilizing a dependent type system.	+25
TOTAL ADAPTER CURRENT ESTIMATED WEIGHT CHANGES FROM BLOCK I TO BLOCK II	-50

BLOCK I

COMMAND MODULE

POTENTIAL WEIGHT CHANGES

STRUCTURE	(+7)
Relocate equipment on aft bulkhead providing new stowage containers for lithium hydroxid. (Item STR-1)	+7
ENVIRONMENTAL CONTROL	(+80)
Add water for cooling during earth orbit based on the inability of the radiators to supply sufficient cooling. (Item ECS-1)	+78
Add restrictors and filters to surge tank subsystem to limit the oxygen demand flow on the cryogenic system when the ECS oxygen subsystem is in the high flow condition. (Item ECS-2)	+1
Add an oxygen tank required for backup of surge tank during re-entry for vehicles which do not carry PLSS's. (Item ECS-3)	+1
EARTH LANDING SYSTEM	(+1)
Increase sea dye marker life to 12 hours in lieu of 6 hours per NASA/NAA Recovery Aids Meeting. (Item ELS-1)	+1
ELECTRICAL POWER	(+53)
Increase wiring provisions based on potting connectors due to humidity requirements. (Item EPS-1)	+30
Increase entry-post landing batteries based on current landing and post landing loads. (Item EPS-2)	+21
Provide a communication adapter cable to facilitate use of the Apollo Block I space suit. (Item EPS-3)	+2
COMMUNICATIONS	(-3)
Study implementation of utilizing HF Recovery Antenna from DeHavilland Aircraft Ltd. (Item COM-1)	-3
CONTROLS & DISPLAYS	(-20)
Incorporate integral illumination of FDAI. (Item C&D-1)	+3
Delete the Entry Monitoring System from the Block I consistent with NASA direction. (Item C & D-2)	-23
TOTAL COMMAND MODULE POTENTIAL WEIGHT CHANGES	+118

BLOCK I

SERVICE MODULE

POTENTIAL WEIGHT CHANGES

INSTRUMENTATION	(+15)
Add R & D flight qualification sensors and signal conditioners required for Block I vehicles. (Item. Instr. - 1)	+15
ELECTRICAL POWER	(+49)
Increase fuel cell based on latest vendor status reflecting provisions for parallel module operation and addition of start-up potasium hydroxide wetting agent. (Item EPS-1)	+19
Increase wiring provision based on potting connectors due to humidity requirements. (Item EPS-2)	+15
Add R & D flight qualification wiring required for Block I vehicles. (Item EPS-3)	+15
REACTION CONTROL	(+27)
Increase reflectors and insulation based on Service Module boost heating and RCS plume impingement requiring addition of cork installation. (Item RCS-1)	+15
Add Service Module RCS propellant tankage vents to increase service life of propellant tanks by reducing the cycling of bladder during the fill and drain operation. (Item RCS-2)	+12
TOTAL BLOCK I SERVICE MODULE POTENTIAL WEIGHT CHANGES	+91

BLOCK I

LAUNCH ESCAPE SYSTEM

POTENTIAL WEIGHT CHANGES

C/M BOOST PROTECTIVE COVER	(+45)
Increase boost cover due to redesign replacing zipper closures with solid laminate edge members, doublers and screws. (Iter LES-1)	+45
TOTAL BLOCK I LAUNCH ESCAPE SYSTEM POTENTIAL WEIGHT CHANGES	+45

BLOCK I

ADAPTER

POTENTIAL WEIGHT CHANGES

Delete the Service Module Dispersal System. (Item ADP-1)	-100
TOTAL ADAPTER POTENTIAL WEIGHT CHANGES	-100